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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/540,809	07/27/2005	Poopathy Kathirgamanathan	LUC-013	1980

7590 05/13/2008

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EXAMINER	
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ART UNIT	PAPER NUMBER
4145	

MAIL DATE	DELIVERY MODE
05/13/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/540,809	KATHIRGAMANATHAN ET AL.	
	Examiner	Art Unit	
	MICHAEL WILSON	4145	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *37-63* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *37-63* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 June 2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20050718; 20071026*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following drawings not mentioned in the description: Figure 10 is not referred to in the detailed description.

2. The drawings are objected to because of labeling inconsistencies. It is not clear what the figure labels are referring to.

On the first drawing sheet there are 4 structures, with all 4 of them being part of Fig. 1, but each of them is separately labeled as Fig. 1a-1d. The second drawing sheet contains six structures, all of them appear to be part of Fig. 2, however they are not identified individually like in Fig. 1, but rather by chemical names. On the fourth drawing sheet there are 4 structures and they all appear to be labeled together as Fig. 4. The sixth drawing sheet there has five structures, the bottom structure is identified as Fig. 6, the top two structures are identified as Fig. 14a and 14b. It is unclear if the middle two structures are intended to be part of Fig. 6 or a separate figure. Further, drawing sheet 14 identifies four graphs as Fig. 14, but it is not clear how they related to previously mentioned structures labeled Fig. 14a and 14b

3. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures

appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

4. The specification is objected to because it lacks a brief description of the drawings. Correction is required. See MPEP § 608.01(f).

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 43, 44, 49, 52, 56-61 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 43 and 44, the claims recite materials which may be used for the hole transmitting layer and electron transmitting layers, respectively. However both claims include compounds taught in the specification for use in the opposite transmitting layer (i.e. hole transmitting compound in an electron transmitting layer), rendering the claims indefinite. For the purposes of this action the claims are interpreted to only

include those materials taught by the specification for use in the appropriate layer, hole transmitting materials for claim 43, and electron transmitting materials for claim 44.

Regarding claim 49, the claim is indefinite because it is unclear if the recitation of "a polyaromatic amine complex" is referring to an aromatic amine polymer or an amine compound with multiple aromatic groups attached. For the purpose of this action "a polyaromatic amine complex" is interpreted as --an amine with multiple aromatic groups--.

Regarding claim 52, the claim is indefinite because the Markush group is unclear and confusing. It is unclear what combination of copolymers is required by the claim. For the purposes of this action the claim is interpreted as a polymer of aniline with at least one copolymer selected from the group consisting of o-anisidine, m-sulphanilic acid, o-aminophenol, o-toluidine, o-ethylaniline, o-phenylene diamine, or amino anthracene.

Regarding claim 56, the claim is indefinite because it allows either the first or second electrode to be a cathode while claim 47, from which claim 56 depends, requires a hole transmitting layer between the first electrode and the luminescent layer. This would necessarily make the first electrode an anode; the first electrode can not be both a cathode and an anode making the claim indefinite. Claims 57-61 are indefinite by dependency. For the purposes of this action the claim the phrase "one of said electrodes" is interpreted as --the second electrode--.

Further regarding claim 59, the claim limits the electron transmitting material to having a general formula of $Mx(DBM)_n$. However the electron transmitting material was

previously limited to a metal quinolate (claim 56). Metal quinolates do not have a general formula of $Mx(DBM)_n$, therefore the claim is indefinite. For the purposes of this action the claim is interpreted to be dependent on claim 56 instead of claim 57 because the limitation of the present claim is within the scope of claim 56.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

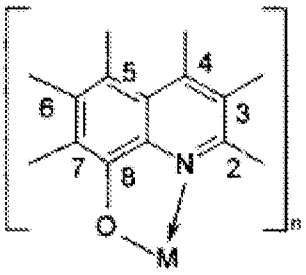
7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 37, 38, 40, 41-45, 47, 48, 56-58, 60, 62, and 63 are rejected under 35 U.S.C. 102(b) as being anticipated by Thompson et al. (US 6,210,814 B1).

Regarding claim 37, Thompson et al. disclose an electroluminescent composition consisting essentially of a mixture of an organometallic compound having the general chemical formula $M(L)_n$ (column 5, lines 3-20), where M is a metal in a valency state n of greater than 3, L is an organic ligand wherein the ligands L can be the same or different, and an effective amount of a fluorescent dopant (column 6, lines 34-40).

Regarding claim 38, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses wherein the organometallic compound has a general formula:



where M is a metal selected from the group consisting of titanium, zirconium or hafnium, each being in the four valency state; n is the valency state of the metal M, and further wherein the substituents are the same or different in the 2, 3, 4, 5, 6 and 7 positions, said substituents being selected from the group consisting of alkyl, alkoxy, aryl, aryloxy, sulphonic acids, esters, carboxylic acids, amino and amido groups, aromatic, polycyclic and heterocyclic groups (column 5, lines 3-20; column 22, lines 30-45).

Regarding claim 40, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses wherein the composition contains up to 10 mol % of dopant (column 9, lines 25-30).

Regarding claims 41 and 42, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses wherein an electroluminescent device comprising in combination:

(i) a first electrode (column 12, line 9),

(ii) a layer of a hole transmitting material (column 12, line 10),

(iii) an electroluminescent layer (column 12, lines 32-34),

(iv) a layer of an electron transmitting material (column 12, line 12), and

(v) a second electrode (column 12, line 13),

wherein the electroluminescent layer comprises a layer of an electroluminescent composition (column 4, line 57- column 5, line25).

Regarding claims 43 and 44, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses an electroluminescent device wherein:

- the hole transmitting layer is an aromatic amine complex (column 13, lines 20-25);
- the electron transmitting material is selected from a metal quinolate (column 13, lines 25-28).

Regarding claim 45, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses wherein

- the hole transmitting material and the electroluminescent compound are mixed to form one layer (column 12, lines 32-45),
    - a proportion of the two materials ranging from about 5 to 95% of the hole transmitting material to 95 to 5% of the electroluminescent compound (column 9, lines 25-30);
- or wherein the electron transmitting material and the electroluminescent compound are mixed to form one layer (column 12, lines 32-45),
    - in a proportion of the two materials ranging from about 5 to 95% of the electron transmitting material to 95 to 5% of the electroluminescent compound (column 9, lines 25-30).

Regarding claims 47 and 48, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses wherein there is a layer of a hole transmitting material positioned between the first electrode and the electroluminescent layer (column 12, lines 9-10 and 33-34), and wherein the hole transmitting material is an aromatic amine complex (column 2, line 65- column 3, line15).

Regarding claims 56-58, and 60, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses wherein

- one of said electrodes is a cathode and further (column 12, line 12-13);
- wherein there is a layer of an electron transmitting material between the cathode and the electroluminescent compound layer (column 12, lines 11-12, and 33-34);
- the electron transmitting material is a metal quinolate (column 3, lines 15-29);
- the electron transmitting material is aluminum quinolate (column 3, lines 15-29).

Regarding claim 62, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses wherein the first electrode is a transparent electricity conducting glass electrode (column 13, lines 1-5)

Regarding claim 63, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses wherein the second electrode is selected from aluminum, calcium, lithium, magnesium and alloys thereof, and silver/magnesium alloys (column 13, lines 33-36).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. Claims 39, 46, 49-51, 53, 54, and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson et al. (US 6,210,814 B1) as applied to claims 37, 42 and 47 above and in view of Hirai et al. (US 2001/0028962 A1).

Regarding claim 39, Thompson et al. disclose all the claim limitations as set forth above. Additionally, the reference discloses wherein the dopant may be DCM1, DCM2, or other suitable dopant molecules known to one of ordinary skill in the art (column 6, lines 37-40).

Hirai et al. teach perylene and acridine compounds as suitable light emitting compounds for an electroluminescent device [0039].

It would be obvious to one of ordinary skill in the art at the time of the invention to use perylene or an acrylene compound, such as a diphenylacridine, in the device of Thompson et al. given the teachings of Hirai et al. that such compounds are suitable light emitting compounds for an electroluminescent device. Both references teach similar electroluminescent devices. One of ordinary would further be guided in the selection of a specific compound by the desired color-emission of the device.

Regarding claim 46, Thompson et al. disclose all the claim limitations as set forth above. However the reference does not explicitly disclose wherein there is a copper phthalocyanine layer on the first electrode and a metal fluoride layer on the second electrode.

Hirai et al. teach a layer of copper phthalocyanine on the anode and a layer of LiF on the cathode [0054]. The reference also teaches that placing a layer between the hole transporting layer and the anode allows the organic layers to be thickened without increasing drive voltage preventing light emitting irregularities and short circuits [0050].

It would be obvious to one of ordinary skill in the art at the time of the invention to combine the hole and electron injecting layers of Hirai et al. with the device of Thompson et al. Both references disclose similar electroluminescent devices. One of ordinary skill would be motivated by a desire to keep drive voltage low and prevent short circuits. Additionally, one of ordinary skill would recognize that addition of carrier injection layers (hole and electron) would improve the injection of those carriers into the electroluminescent layer, improving device performance.

Regarding claims 49, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses several compounds for use in a hole transporting layer (column 13, lines 20-25). However the reference does not explicitly disclose a polyaromatic amine complex as hole transporting materials.

Hiria et al. teach aromatic tertiary amines as suitable material for the hole transporting layer of an electroluminescent device [0037]. Aromatic tertiary amines are commonly polyaromatic amine complexes.

It would be obvious to one of ordinary skill in the art at the time of the invention to use a polyaromatic amine complex as the hole transporting layer in the device of Thompson et al. given the teachings of Hirai et al. that such compounds are suitable for use as the hole transporting material of an electroluminescent device.

Regarding claims 50, 51, 53, and 54, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses several compounds for use in a hole transporting layer (column 13, lines 20-25). However the reference does not explicitly disclose polymers, conjugated polymers, or polyaromatic amines as hole transporting materials.

Hiria et al. teach conjugated polymers including poly(vinylcarbazole), polyphenylene, polythiophenes, and polyaniline as suitable material for the hole transporting layer of an electroluminescent device [0037].

It would be obvious to one of ordinary skill in the art at the time of the invention to use a polymer such as polyaniline, poly(vinylcarbazole), or polythiophene as the hole transporting layer in the device of Thompson et al. given the teachings of Hirai et al. that

such compounds are suitable for use as the hole transporting material of an electroluminescent device.

Regarding claim 61, Thompson et al. disclose all the claim limitations as set forth above. However the reference does not disclose wherein the electron transmitting material is mixed with an effective amount of the electroluminescent compound [0041].

Hirai et al. teach that the electroluminescent material may be added to the hole or electron transporting layers making those layers also act as light-emitting layers.

It would be obvious to one of ordinary skill in the art at the time of the invention combine the teachings of Hirai et al. with the device or Thompson by adding luminescent material to the electron transport layer. Both references disclose similar electroluminescent devices. One of ordinary skill in the art would be motivated by the desire to make the electron transport layer also light-emitting. Further one of ordinary skill in the art would reasonably expect success given the teachings of Hirai et al. that luminescent material may be added to the electron transporting layer of an electroluminescent device.

12. Claim 55 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson et al. (US 6,210,814 B1) as applied to claim 47 above and in view of Marrocco et al. (US 2002/0028347 A1).

Regarding claims 55, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference teaches that the hole transport layer may be integrated into the light-emitting layer for a single light-emitting/hole-transport layer

(column12, lines 33-45). However the reference does not explicitly disclose wherein the electroluminescent compound is mixed with an effective amount of the hole transmitting material.

Marrocco et al. teach the hole transport and luminescent layers may be mixed [0058].

It would be obvious to one of ordinary skill in the art at the time of the invention to combine the teaching of Marrocco et al. with the device of Thompson et al. to make a mixed luminescent layer having an effective amount of hole transmitting material. One of ordinary skill in the art would be motivated by the desire to make the luminescent layer more hole transporting and would reasonably expect success given the teachings of Marrocco et al. that the materials of the hole transporting and luminescent layers may be mixed.

13. Claim 59 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson et al. (US 6,210,814 B1) as applied to claim 56 and 57 above and in view of Hong et al. (Electron-transport properties of rare earth chelates in organic electroluminescent devices.).

Regarding claim 59, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses several compounds as electron transport materials (column 13, lines 26-30). However the reference does not explicitly disclose a compound with the general formula $Mx(DBM)_n$ as an electron transporting material.

Hong et al. teach compounds with a general formula of $Mx(DBM)_n$ as electron transport materials (page 273, conclusion). The reference specifically teaches chelates of Y^{+3},La^{+3}, Gd^{+3}, and Er^{+3} as good electron transport materials (page 272, second column, lines 2-6), and teaches that using these compounds can lower drive voltage and increase stability (page 273, conclusion).

It would be obvious to one of ordinary skill in the art at the time of the invention to use the compounds of Hong et al. in the electron transport layer of Thompson et al. given the teachings of Hong et al that such compounds are suitable for use in the electron transport layer of an electroluminescent device. One of ordinary skill would be motivated by a desire to lower drive voltage and increase stability.

14. Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson et al. (US 6,210,814 B1) as applied to claim 47 above and in view of Yang (US 5,723,873).

Regarding claim 52, Thompson et al. disclose all the claim limitations as set forth above. Additionally the reference discloses several compounds for use in a hole transporting layer (column 13, lines 20-25). However the reference does not explicitly disclose wherein the hole transporting material is a polymer of aniline with copolymers of o-toluidine or o-ethylaniline.

Yang teaches a layer of aniline polymer with copolymers of o-toluidine or o-ethylaniline (column 7, lines 9-24) between the anode and electroluminescent layer (column 4, lines 48-55, and figure 2). The layer as taught by the reference would

inherently perform the function of a hole injecting/transport layer. The reference also teaches that using such a layer results in increased efficiency and lower turn-on voltage (column 3, lines 13-15).

It would be obvious to one of ordinary skill in the art at the time of the invention to use polymer of aniline with copolymers of o-toluidine or o-ethylaniline as the hole transport material in the device of Thompson et al. One of ordinary skill would recognize that polymer of aniline with copolymers of o-toluidine or o-ethylaniline would be suitable given the teachings of Yang and would be motivated by a desire to increase efficiency and lower turn-on voltage.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kim et al. (US 2002/0045063 A1) discloses similar complexes of Zr^{+4}, Ti^{+4}, and Hf^{+4} as luminescent material in an organic electroluminescent device.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL WILSON whose telephone number is (571) 270-3882. The examiner can normally be reached on Monday-Thursday, 7:30-5:00PM EST, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on (571) 272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MHW

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 4145